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DIOPHANTINE ANALYSIS.

120. Proposed by L. E. DICKSON, Ph. D., The University of Chicago.

Find the prime numbers p for which $x^2 - pxz - px - z + p^2 - 3 = 0$ has more than two sets of positive integral solutions x, z , each $< p$.

Remark by G. B. M. ZERR, A. M., Ph. D., Parsons, W. Va.

The following sets of values satisfy the required conditions: When $x=1$, $z=p-2$; when $z=1$, $x=p-2$. When $z=x-2$: $x=\frac{1}{2}+\frac{1}{2}\sqrt{(4p+5)}$, $z=\frac{1}{2}\sqrt{(4p+5)}-\frac{3}{2}$, hence when $4p+5$ is a square there are more than two sets of values x, z , each $< p$.

$\therefore p=11$; $x=1, 4, 9$; $z=9, 2, 1$. $p=41$; $v=1, 7, 39$; $z=39, 5, 1$.

$p=19$; $x=1, 5, 17$; $z=17, 3, 1$. $p=71$; $x=1, 9, 69$; $z=69, 7, 1$.

$p=29$; $x=1, 6, 27$; $z=27, 4, 1$. $p=89$; $x=1, 10, 87$; $z=87, 8, 1$.

AVERAGE AND PROBABILITY.

150. Proposed by F. P. MATZ, Sc. D., Ph. D., Professor of Mathematics and Astronomy in Defiance College, Defiance, O.

If the length of a circular arc be b and the radius vary uniformly, what is the average area of all the segments possible?

Remark by G. B. M. ZERR, A. M., Ph. D., Parsons, W. Va.

Evaluating $\Delta = \lim_{y=0} \int_y^{2\pi} \left(1 - \frac{\sin y}{y}\right) \frac{dy}{y^3} / \int_y^{2\pi} \frac{dy}{y^2}$, in my solution on p. 41, we find that,

$$\begin{aligned} \Delta &= \lim_{y=0} \frac{L}{2\pi-y} \int_y^{2\pi} \left(1 - 1 + \frac{y^2}{3!} - \frac{y^4}{5!} + \frac{y^6}{7!} - \frac{y^8}{9!} + \dots\right) \frac{dy}{y^3} \\ &= \lim_{y=0} \frac{L}{2\pi-y} \int_y^{2\pi} \left(\frac{1}{6y} - \frac{y}{5!} + \frac{y^3}{7!} - \frac{y^5}{9!} + \dots\right) dy \\ &= \lim_{y=0} \frac{L}{2\pi-y} \left[\frac{1}{6} \log \frac{2\pi}{y} - \left(\frac{y^2}{2 \cdot 5!} - \frac{y^4}{4 \cdot 7!} + \frac{y^6}{6 \cdot 9!} - \dots \right) \right]_y^{2\pi} \\ &= \lim_{y=0} \frac{L}{6(2\pi-y)} \log \frac{2\pi}{y} = \lim_{y=0} \frac{L}{6} b^2 y \log \frac{2\pi}{y}. \end{aligned}$$

When $y=0$, $y \log \frac{2\pi}{y} = 0 \times \infty$. But $y \log \frac{2\pi}{y} = \log \frac{2\pi}{y} \div \frac{1}{y}$; and by differentiating numerator and denominator, $\Delta = \frac{-(2\pi/y^2)/(2\pi/y)}{-(1/y^2)} = y=0$, when $y=0$, instead of $b^2/8\pi$.

Also solved by Henry Heaton, Atlantic, Iowa, with the result $\Delta=0$.

153. Errata. For $1/6a$ read $a/6$.